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DEPARTMENT OF AGRICULTURE.

Dept Report 28

PRELIMINARY REPORT

ON

THE FORESTRY

OF THE

MISSISSIPPI VALLEY,

AND

TREE PLANTING ON THE PLAINS.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

LETTER OF TRANSMITTAL.

TOPEKA, KANS., November 16, 1882.

Hon. GEORGE B. LORING,

Commissioner of Agriculture:

SIR: The terms of the commission issued to the undersigned, bearing date July 25, 1882, instruct him to investigate and report upon the "forestry and forestry necessities of the States and Territories of the Mississippi Valley and east of the Rocky Mountains." In the limited time allowed for the preparation of this preliminary report the attempt has been made to ascertain the conditions and necessities of the country west of the Mississippi and east of the Rocky Mountains.

In the preparation of this report the writer has recognized the duty of addressing himself not to special classes, as scientists or professional arboriculturists, but to "all whom it may concern," to the end that every man who owns his "rood of ground" may become interested in the subject of tree-growing, and so co-operate in carrying out the purpose for which the bureau of forestry was established.

For the convenience of the reader the subject-matter herein contained is divided under three heads:

1. The natural condition of the region, as found by the early settlers, or, "what nature did."
2. The changes that have been wrought by the progress of settlement and through the agency of individuals and the national and State governments, or, "what man has done."
3. The question of the future development of forestry, with some few practical suggestions as to the duty of individuals, corporations, and the State and national governments, or, "what should be done."

Respectfully yours,

F. P. BAKER.

PRELIMINARY REPORT ON FORESTRY.

NATURAL CONDITIONS.

The vast country assigned to the writer for investigation is bounded on the east by the Mississippi, on the west by the winding chain of the Rocky Mountains, and extends from the British possessions to the warm waters of the Gulf. It embraces the States of Minnesota, Iowa, Missouri, Arkansas, Louisiana, Nebraska, Kansas, Texas, and a portion of Colorado, and portions of the Territories of Dakota, Montana, Idaho, New Mexico, Arizona, and the Indian Territory. Of this region the States of Missouri, Arkansas, and Louisiana are largely covered with native forests, and Arkansas in particular stands in need of facilities for bringing her magnificent lumber to market, and the day, it is hoped, is not far distant when the cypress of Arkansas will be as well known as the pine of Michigan and Wisconsin. Outside of these three States—Missouri, Arkansas, and Louisiana, which will be set aside for the present, to be spoken of hereafter—there yet remains an empire to which the subject of forestry is at present a vital one. The Mississippi throughout its length is lined by forests which increase in width as the number and size of its tributaries increase in volume. It is the presence of this great river which may be said to make forest States of the three we have mentioned.

In Minnesota the belt of forest is comparatively narrow; in Iowa somewhat wider, and it is in those States that the great prairie region begins which extends to the foot-hills of the Rocky Mountains. Going west from the Mississippi the Missouri is encountered, lined with forests for the last 200 miles in its course, above that running through a comparatively deforested region.

At the Missouri begins the ascent to the Rocky Mountains, the great field for the future exercise of all that man has learned or can acquire of the science of forestry. This region, as the elevation increases, becomes more bare, and, to the eye accustomed to mountains and forests, desolate. The forest keeps up a gallant struggle along the streams which flow eastward to the Mississippi and Missouri, the Platte, the Kaw, and the Arkansas, but finally diminishes to a thin, winding fringe of cottonwood or willows, and the eye for hundreds of miles sees no more till the pine-covered slopes of the Rocky Mountains appear dimly in the horizon. The traveler, coming within sight of the mountains and then turning southward, comes to New Mexico, with its mountains,

oft times bare to their very summits, and at other times covered with piñon and pines; its wide plains watered by inconstant, treeless streams and occasional ponds or lakes, traversed by but one stream of magnitude—the red, turbid Rio Grande, its banks destitute of trees or verdure save where the patient Mexican has dug his acequia or irrigating ditch. Then to the westward lies Arizona, a country of mountains, bearing everywhere the traces of volcanic action, extinct craters, lava beds, and the veritable sandy desert. As the border of Mexico is approached the barrenness increases. Nothing relieves it save where man has overcome it by irrigation. The Mexican does not rely on trees for his wood, but digs for fuel the heavy, branching roots of the mesquite. If the traveler, when within sight of Pike's Peak, turns northward instead of southward, and keeps his course parallel with the mountains, his way will lead him over the high plains, better watered and less desolate than those of New Mexico, but equally destitute of trees. Such is a general view of the country under discussion.

When the first settlement of this region began, the north half of Minnesota was covered with white pine, and south and west of the pine belt was a large body of hard wood, consisting of white, red, and burr oak and sugar maple. Of the total forest of the State (pine and hard wood mixed, and hard wood), it is safe to say that fully one-half has disappeared. Of the total area of hard wood, it is estimated that but 4,000,000 acres remain, the area of the State being, in round numbers, 54,000,000 acres.

The history of Iowa is that of the prairie States generally. The settlers found on the banks of the Mississippi, the Des Moines, its principal tributary, and other streams, a considerable amount of timber. This they proceeded to use up, after the manner of the American pioneer, particularly when he encounters timber on the government lands. Nature has since been repairing damages, but native timber has long since ceased to be a matter of reliance. In 1875 the forest area of Iowa was estimated at 2,300,000 acres, the area of the State being 35,000,000 acres.

Nebraska, as opened for settlement, was almost entirely destitute of timber. The supply was confined to the belt along the shifting banks of the Missouri, largely composed of willows and cottonwoods, with a hard growth in the bluffs and the ravines which intersect them. At the mouth of the Platte was a heavy body of cottonwood, and along the banks of that stream, where it was entered by tributaries, were groves of white and burr oak in area from 100 to 500 acres. Within the original limits of the Omaha land district, containing 2,560,000 acres, and comprising the most heavily timbered district of the State, the original plats showed but 75,000 acres of timber.

Kansas, although counted among the "treeless" States, was, in the beginning, blessed with more forest than Nebraska. Pike, who explored the country in 1806, speaks of the region now comprising the

east third of the State as a good country; but beyond the first 100 miles from the present border of the State of Missouri, he doubted if the country could be settled on account of the absence of wood. Within twenty years a fine body of forest extended along the Kansas River from its mouth to 135 miles west. In some localities, as at Topeka, 60 miles west of the mouth of the river, the body of timber, comprising fine specimens of every tree known to the latitude, was six miles wide. Colonel Fauntleroy, in urging in 1852 the establishment of the post since known as Fort Riley, at the point where the Republican and Smoky Hill unite to form the Kansas River, mentions the locality as desirable on account of the existence of one of the finest bodies of timber in the West. The banks of the Neosho, from Council Grove to the present line of the Indian Territory, were heavily timbered. Large bodies of cottonwood were found at Lake Sibley and other points on the Republican. The Marais des Cygnes, and in fact nearly all the streams of Eastern Kansas, were well timbered. Even in the extreme northwestern portion of the State, nearly to the borders of the plains of Colorado, fine groves existed on the small tributaries of the Republican, one of them being early named the Driftwood. After all the ravages of twenty years the amount of timber in the State is estimated at 2,560,000 acres, or 4.92 per cent. of the whole area.

Colorado had, at the time of the discovery of its mines, 25 years ago, a great body of pine, spruce, fir, and other trees covering its mountain sides. In 1870 it was estimated one-third, possibly one-half, of the trees in the settled portions of the Territory had been destroyed by fire and ceaseless slashing. Since that period railroads have penetrated the country, and have added to the destruction by consuming millions of ties. The original forest lands of Colorado are now being converted into deserts.

Wyoming is a country of high plains and lofty mountains. In 1873 it was estimated that there were 2,000,000 of acres of timber in Northwestern Wyoming. The business of cutting off the timber for railroad ties has been going on for many years. The consumption has been estimated at 500,000 ties per annum. Charcoal burning and the demand for mining purposes have also diminished the native timber. The elevation of the country renders it liable to frost every month in the year except July, which enhances the difficulties surrounding artificial forestry.

The mountains of Montana were originally covered with forests of pine, spruce, fir, cedar, and balsam. These forests have been ravaged by fire, and it has been noticed that where timber is once destroyed on these mountains it is not followed by a second growth.

Idaho presents great contrasts of surface and vegetation. The finest body of red cedar on the continent exists in this Territory, and, on the other hand, there are 16,000,000 acres of sage-brush lands, which are, however, for the most part, susceptible of irrigation, and so offer a field for tree cultivation.

Dakota is a prairie country, and resembling in its general characteristics the adjoining portions of Nebraska and Minnesota.

It will be seen that the region west of the Mississippi and east of the Rocky Mountains comprises a great variety of soil and climate, and really the region should be divided into great districts, each to be made the subject of investigation and report. In such a division one district might be properly made of Minnesota and Iowa; another of Eastern Dakota, Nebraska, and Kansas; another of Wyoming, Western Dakota, Montana, Idaho, and Colorado; another of New Mexico and Arizona; and yet another of Missouri, Arkansas, Louisiana, Texas, and the Indian Territory. In some sections timber grows naturally in abundant supply; in others the need is planting and cultivation; in others in addition to planting and cultivation, irrigation seems a necessity. In other districts the question is that of preservation.

Every portion of our country is interesting in connection with the purposes and labors of the bureau of forestry, but the most interesting field of research and labor is that portion of the continent which is embraced within the limits of the States and Territories we have mentioned, and the boundaries of which were defined as follows by Mr. H. M. Thomson, of Lake Preston, Dak., in a paper read before the Forestry Congress at Montreal at the meeting in August, 1882:

The Great Plains extend from the southern limit of the Staked Plains in Texas northwardly about 20 degrees of latitude to the Saskatchewan River and Hudson's Bay, and from an irregular east line, commencing in Texas, running through the eastern part of the Indian Territory, Eastern Kansas and Nebraska, Western Iowa, the big woods of Minnesota, and the Red River of the North; westwardly of this irregular eastern limit an average distance of about 10 degrees of longitude to the foot-hills of the Rocky Mountains, and containing an area of about 950,000 square miles. If all this region possessed a propitious climate, and all the soil were susceptible of cultivation, the area is sufficient to make 3,800,000 farms of 160 acres each, and which, by the aid of a proper forest economy, may be made capable of supporting an agricultural and pastoral population of fifty millions.

WHAT HAS BEEN DONE.

The first great step toward the promotion of forestry in this country was what may be called a change of sentiment in regard to the value of forest trees, a change which has taken place within the last half century. The pioneers on the continent made their settlements along a heavily-timbered coast, and for the better part of two centuries literally hewed their way toward the interior of the country until the great prairies were reached. Trees were not only cut down for use, but were slashed and burned and girdled. It seemed to be the purpose of the early American settler to destroy as far as possible the native forest. The woodman's ax was the symbol of civilization, and the State seal of Indiana bears the figure of a wood-chopper.

The setting out of orchards was, of course, the work of the earliest pioneers, a passion for fruit trees having been brought from England;

but the idea that a forest tree was of any value except to be used up for rails or posts or boards, or burned to ashes for pearlash, is of comparatively modern origin. Even when the settler reached the prairies of Illinois, where timber compared with the older States was very scarce, he does not appear to have exercised the least care or foresight. If he lived near the bodies of forest which skirted the streams, he cut them down for rails or cord wood, as if the supply was inexhaustible, and out in the prairie the settler contented himself with hauling green wood a long distance for firing, nor dreamed of setting out groves about his house which should supply his demand for fuel at less trouble and expense.

Kindly nature strove to repair damages, and in many instances successfully. And when, in time, men heeded the warning and became less lavish in the work of destruction, the woodland began to gain in area, until in many parts of Illinois it is now much greater than when the country was first settled. In time came the discovery of coal, which lessened the consumption of wood for fuel; and the question of material for fencing becoming serious, hedges and other substitutes for posts, plank, and rails were resorted to. Thus by degrees the subject of the value of forest, and so the possibilities of forest culture, became impressed upon the people; in short, forestry became a subject of popular interest.

An augmentation of this interest came with the settlement of the country west of the Mississippi, and more especially west of the Missouri. Here were immense treeless areas, and believed by the first explorers to be uninhabitable on account of the absence of forest for building, fencing, or even fuel; it was known that travelers and hunters traversing these plains used buffalo chips for fuel. And yet here were millions of acres of surpassing fertility, opened to settlement by the passage of the homestead act; and the progress of settlement stimulated by the extension of the railroads. It will be seen that under these conditions the forest question became one of the first importance. The rivers and the railroads solved the problem of building by bringing pine from the forests of the North, and the demand for fuel was met in part by the opening of mines of bituminous coal, which seem providentially to exist in most prairie countries. The fence question was met in Nebraska and Kansas by the general adoption, after much discussion, of the herd law, which does away with large farm inclosures. In the settlement of these trans-Missouri States every step tended to reveal the transcendent value of forests. The lack of them, though supplied as we have said, was felt, and as soon as horticultural and agricultural societies were formed, tree-planting became a subject of eager, active, and constant discussion, and so has continued to be ever since. It is safe to say that there has scarcely been a number of an agricultural or horticultural paper issued in the States of Minnesota, Iowa, Nebraska, or Kansas, in which the subject of tree-planting has not been discussed.

The first efforts to repair the deficiencies of nature were those made by individuals. All through the country embraced in the limits of this report is found a tree of quick and early growth, requiring little in the way of sustenance, living a long time on water alone, planting itself in the most unexpected places and sowed by the busy winds. This tree is the cottonwood, and being the first at hand it was everywhere seized upon by the settler and planted by thousands about the homestead shanty, along the boundaries of the prairie claim, and in the little public squares and along the streets of the villages which spring up in a week or a month. Although time and trial have proved that the cottonwood will not sustain itself on the high prairie unless carefully cared for, dying like the Indian with the growth of civilization, it will yet be held in remembrance in this western country as the first of trees, and its planting as the beginning of forestry. Many a settler in years to come will recount how the armful of little cottonwoods, which he pulled with his hands on the sandy bank of the river and carried to his claim, furnished in time the first shelter from the fierce winds and the burning sun.

In time the pioneer tree was followed by others, the black walnut, the maples, the box elder, the catalpa, and with wonderful success. The denizen of the town in Minnesota, Iowa, Kansas, and Nebraska proved quite as enthusiastic a tree-planter as the farmer in the country, and in Kansas the newer the town, as a rule, the more zeal has been displayed in the matter of tree-planting. Lawrence, the university city of Kansas, after twenty-five years is a town full of verdure; but the same is true of Wichita, a town which seven years ago stood treeless on the bare, sandy bank of the Arkansas.

As to the results of individual effort, without encouragement from the State or from societies, a small portion of the immense amount of evidence which might be furnished is herewith submitted.

The latest standard authority on tree culture in Kansas is the "Second report on Forestry, by the Kansas State Horticultural Society." In this pamphlet, in the shape of county reports, is briefly summarized the results of tree-planting in Kansas, together with the teachings of experience in regard to proper varieties, &c.

The counties reporting, through careful observers and practical tree-growers, are Allen, Atchison, Barbour, Barton, Butler, Chautauqua, Cherokee, Crawford, Cloud, Cowley, Davis, Dickinson, Edwards, Ellis, Elk, Harper, Harvey, Jackson, Jefferson, Jewell, Johnson, Kingman, Labette, Leavenworth, Lincoln, Lyon, Marshall, Miami, Mitchell, Macpherson, Montgomery, Morris, Pratt, Ness, Nemaha, Neosho, Ottawa, Pawnee, Pottawatomie, Reno, Rice, Rush, Russell, Saline, Sedgwick, Sumner, Wallace, Washington, and Woodson. A glance at the map of Kansas will show that these counties represent every variety of soil and climate within the limits of the State, and from the earliest settled counties, on the banks of the Missouri, to the newest, far out on the high

plains, and from the Nebraska line to the Indian Territory. The highest of high prairie and the low level bottoms of the Arkansas, but a few feet above the level of the river, alike send the same report, "Timber culture seems to be made profitable in this county."

Taking the older counties, Leavenworth reports:

Timber groves were planted in 1860, of cottonwood chiefly, and on upland, many of which are 50 feet high.

And taking the newer counties, Saline reports:

The age of the oldest successfully grown timber lot or grove in the county is not over ten years old; was planted on low lands, and composed of cottonwood. The average diameter of these trees is 12 inches and the height 50 feet.

The correspondent from Sumner County reports:

Timber-growing can be made a profitable investment. My first planting, now eight years old, affords me posts and poles for their uses on the farm and considerable fuel. I would not be without it for \$50 an acre.

These extracts are from the report two years old; as to later evidence, Hon. Martin Allen, of Ellis County, an old resident of extreme western Kansas, writes:

I have myself been cutting and using timber for a number of years that has grown on the prairie since I came here, and many others within my knowledge are doing the same. Even the slow-growing black walnut has made annual additions of near an inch in the diameter of its trunk.

Hon. H. C. St. Clair writes from Belle Plain, Sumner County, Kansas:

In this county there are thousands of acres of cultivated timber. Every good farmer, one that has now come to stay, has from one to ten, and some twenty, acres in timber, consisting of cottonwood, walnut, ash, elm, box elder, maple, ailanthus, and catalpa. It is true that some varieties are of slow growth, and a beetle destroys the cottonwood on the high lands; but where timber lots are cultivated like an orchard, as they should be, timber-raising is a success, and money spent by the government to encourage timber culture on the plains is well spent.

Theodore Boggs writes from McPherson County, in Western Kansas:

There have been a great number of timber filings made in this county, and while some of them have been changed to homestead or pre-emption entries, there are a great many timber claims under a good state of cultivation, and the trees in most instances are healthy and doing well. I have trees on my farm near McPherson planted in the spring of 1873 that are as large at the butt as a man's thigh, and they are healthy and show no signs whatever of decay. The repeal of the timber-culture act would be a very bad thing for the plain regions, and I should be sorry to have it done. There are timber claims in this county that could not be had for \$5,000, and inside of five years they cannot be had for \$10,000. There is no question about the success of timber on these prairies if it is only planted and cared for.

So much may be gathered of the results of tree-planting in Kansas.

Nebraska in the matter of systematic forestry is far in advance of Kansas. Possessing a much smaller area of natural timber than Kansas, the efforts of the people to cultivate artificial forests have been more vigorous. The statement is made by J. T. Allen, forester of the Union Pacific Railroad, that Nebraska has now growing, and in the best possible condition, *forty-five million* of forest trees, and this planting extends 300 miles west of the Missouri River.

SUCCESS OF THE MENNONITES.

Under our homestead system, in fact under the general system by which the West has been settled, there have been exhibited few of the benefits of co-operation. Each settler is independent. He is supreme on his own quarter-section, giving and receiving little help from others. Were this different, did the settlers of a given district join with each other in developing the country, did they combine, for instance, in the great work of rendering the land beautiful and profitable with trees, much could be done. How much is shown by the example of the Mennonites in Kansas! These people, bound together by a community of race and religion, and the fact that they were all alike "pilgrims and strangers" in this country, emigrated from Russia in large bodies in 1876 and 1877, and settled for the most part in the counties of Harvey, McPherson, Marion, Butler, and Reno. They bought land in severalty, yet in contiguous tracts, and have, without being allied in any socialistic bond, aided each other in their labors. Settling in an open prairie country they have transformed it. Being intelligent tree-plauters they have surrounded their dwellings with fruit and forest trees, so that at a little distance a Mennonite settlement looks like a grove. They early introduced the culture of the Russian mulberry, which, under their system of careful cutting, furnishes in three years from the start abundant fuel, beside fruit, and the leaves for feeding the silk-worms. The same care and skill everywhere displayed would transform the great plains and change the climate of the western half of the United States.

ARBOR DAY.

An instance of the value of united action, even though for a brief period, is seen in the institution of "Arbor Day." The credit of designating a certain day in the year when men, women, and children shall join in planting trees is due first to the State of Nebraska. It was later taken up by the State Forestry Association of Minnesota, and on the first Arbor Day in that State, in 1876, 1,500,000 trees were planted. Premiums were offered by the State Forestry Association and by individuals until every farmer in Minnesota seems to be a forester. In Iowa Arbor Day has become a fixed institution. In Kansas the day was first observed by the citizens of Topeka, who turned out under a proclamation from the mayor and filled the capitol grounds with trees, which remain to this day. The governors of Kansas have since issued their proclamations for the observance of Arbor Day, which has been observed, however, principally by the school children who have by their efforts greatly beautified many school grounds in the State.

ACTION OF RAILROAD COMPANIES.

We have spoken heretofore of the work of individuals. The work of forestry has been carried on to some extent by railroad companies, but

not to the extent desirable. The Atchison, Topeka and Santa Fé Railroad Company in Kansas some years ago employed a forester, but afterwards, probably believing that the experience of private parties had fully demonstrated the fact that trees *would* grow to the extreme western limits of Kansas, abandoned the experiment. The following statement is instructive in this connection: Under date of October 18, 1882, Mr. C. H. Longstreth, late forester of the Atchison, Topeka and Santa Fé Railroad Company, speaking of the efforts of that corporation to grow trees on the great plains, after it had been a question of great doubt whether trees could be grown there at all, states that, in connection with S. T. Kelsey, in 1873, he commenced tree-planting at Hutchinson, Kans., working from there westward. He says:

The object of our work was to settle this question and learn as far as possible what kinds of trees were best adapted to this part of the State for forest purposes. We did not do much until the spring of 1874, when we did considerable in the way of planting seeds and cuttings, most of which grew and promised well. In February, 1875, Mr. Kelsey left the work, after which I continued the planting and growing of trees until 1879, when, having the grounds all filled out and trees in such shape as to require but little care thereafter, the railroad company concluded best to discontinue the work and not plant any further.

Since 1879 the trees have had no work expended on them whatever. Below, I give notes of growth and number of trees now growing, which I took a few days since:

First point, Hutchinson, is 180 miles west of the east line of the State; elevation, 1,500 feet; soil, light, sandy loam. Here are now growing—

	No. of trees.
Cottonwood, 30 to 50 feet high	1,000
Box-elder (ash-leaved maple), 15 to 20 feet high	8,000
Black walnut, 12 to 18 feet high	2,500
Green ash, 15 to 20 feet high	3,600
Ailanthus, 18 to 24 feet high	1,200
Catalpa, 16 to 20 feet high	2,000
Elm, 15 to 18 feet high	200
Honey locust, 15 to 25 feet high	500
Gray willow, 30 to 40 feet high	500
Hackberry, 6 to 10 feet high	500
Soft maple, 12 to 20 feet high	1,000
Coffee bean, 4 to 6 feet high	3,000

Elinwood, the next point, is 40 miles farther west; elevation, 1,750 feet; soil, a black, sandy loam, with a tenacious subsoil. Here are now growing—

Soft maple, 16 to 20 feet high	600
Honey locust, 15 to 20 feet high	400
Catalpa, 15 to 20 feet high	1,800
Box-elder (ash-leaved maple), 15 to 18 feet high	500
Ailanthus, 18 to 20 feet high	300
Osage orange, 12 to 15 feet high	2,000
Cottonwood, 30 to 40 feet high	2,000
Green ash, 12 to 15 feet high	1,500
Black walnut, 12 to 18 feet high	4,000
Gray willow, 25 to 30 feet high	600
Hackberry, 8 to 12 feet high	400
Elm, 15 to 18 feet high	500

Garfield, the next point, is 43 miles west of Ellinwood; elevation, 2,100 feet; soil, light loam. The following trees are growing here:

Cottonwood, 20 to 30 feet high.....	4,000
Box-elder, 12 to 15 feet high.....	2,700
Ailanthus, 15 to 18 feet high.....	5,000
Black walnut, 12 to 15 feet high.....	4,000
Soft maple, 12 to 15 feet high.....	800
Catalpa, 10 to 14 feet high.....	500
Honey locust, 15 to 20 feet high.....	400
Green ash, 8 to 12 feet high.....	2,000
Gray willow, 20 to 25 feet high	200

The above is a brief description of the results of our work down to the present time. All of these trees have been grown from seeds and cuttings. The conditions have been such as to put the trees to severe tests. There has been no extra work done with them. They have been simply planted and cultivated well. It has been stated that we irrigated a part of our ground. This is not the case. Our trees never received any water except what fell from the clouds. All of these trees at the present time show a promising and healthy appearance, with all prospects of making a rapid and mature growth in the future. This work has demonstrated beyond any question of doubt that trees will grow here with all success whenever planted intelligently and cultivated and taken care of as they should be.

It will be seen that the Atchison, Topeka and Santa Fé Company went no further than experiment to demonstrate that the growth of trees was possible in the region traversed by its line. The same was true of the Kansas Pacific, now the Kansas Division of the Union Pacific. Several experimental gardens or nurseries were started under the direction of the company, but abandoned years ago. Settlers in the same counties where these experimental groves were planted, have, on hundreds of timber claims, settled the point at issue.

The Burlington and Missouri River Railroad, in Nebraska, carried on some experiments for a short time, in the way of planting trees along cuts for snow fences.

The Missouri River, Fort Scott and Gulf Railroad Company has entered upon the work of forestry proper, that is, the raising of trees for actual use.

R. Douglas & Son, of Waukegan, Ill., have a contract with this railroad, which runs from Kansas City south, in Kansas, near the line of Missouri, to and beyond Fort Scott, Kans., to plant two sections of land in trees. One of these is located at Farlington, and the other at Hunnewell, near by. These places are about 125 miles south of Kansas City, Mo. Of the Farlington plantation Mr. Douglas, under date of October 24, 1882, writes:

Three hundred and twenty acres are planted, and we are now planting 180 acres more. That will be finished before winter sets in, or before April 1, 1883. The plantation consists of catalpa (*speciosa*), with the exception of a few acres. They are all planted 4 by 4 feet apart, containing 2,720 trees to the acre. The land is prepared same as for corn, and the trees are planted with spades. The catalpa trees planted in 1878, after four summers' growth, are 10 to 15 feet high and $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in diameter. Three years planted, 5 to 9 feet; two years planted, $3\frac{1}{2}$ to 6 feet (a drought last year); one year planted, 3 to 4 feet. On rich land these trees shade the

ground after two years' cultivation. On poorer land they require three years' cultivation.

On the Hunnewell plantation, 3 miles from Farlington, we have already planted 175 acres catalpa (*speciosa*) and ailanthus, and 60 acres of the white ash. The catalpa are one and two years planted; we will have 285 acres on the above plantation between now and April next, all catalpa and ailanthus, making 560 acres on the Hunnewell plantation. Our contract requires 2,000 trees to the acre when they are 4 to 6 feet high. Nearly every acre on both plantations will contain 2,500 trees; every acre will contain over 2,000 trees.

Beside the Missouri River, Fort Scott and Gulf, the only other railroad company reported as engaged in forestry is the Saint Louis, Iron Mountain and Southern. Mr. Kerrigan, superintendent, writes:

We have no trees planted on our road excepting 50,000 catalpa trees on right of way near Charleston, Mo. We have a plantation or farm of catalpa trees (100,000 trees) on Belmont branch, 18 miles from Belmont, Mo. The above were all raised from seed. We also have a catalpa farm of 250,000 trees at Bertrand, Mo., about 20 miles from Bird's Point, on the Cairo branch of this road. These were planted in June, 1880, from slips. Have been cultivated twice, and are now in fine, thrifty condition. Will average about 8 feet high, and will not require any cultivation after next year.

THE TIMBER-CULTURE ACT.

The general government, acting through Congress, has confined its encouragement of forestry mainly to the passage of the timber-culture act, which grew out of the homestead law, and is designed to be supplementary to it. The original Congressional timber-culture act became a law March 3, 1873. It was amended March 13, 1874, and was on the 14th of June, 1878, changed to the shape it now bears, and since the date of its last amendment most of the entries under the law have been made. That is, the law has been in practical, extensive, working operation but four years.

As showing the extent of operations under the act, the following table, furnished by Hon. N. C. McFarland, Commissioner of the General Land Office, is given:

Statement of the number and area of entries under the timber-culture laws in the different States and Territories, by fiscal years, from the beginning of operations to June 30, 1882.

States and Territories.	1873.		1874.	
	No. of entries.	Acres.	No. of entries.	Acres.
Arizona			2	196.51
California	2	329.75	59	8,878.06
Colorado			17	2,272.24
Dakota	24	3,560.00	865	124,997.29
Iowa	1	145.90	33	3,816.05
Kansas	60	9,642.17	1,954	282,479.07
Minnesota	95	14,710.15	804	113,131.63
Nebraska	137	21,858.07	2,164	312,712.09
Washington			22	2,482.22
Wyoming			1	80.00
Idaho			2	180.83
Total	319	50,246.04	5,923	851,225.99

Statement of the number and area of entries under the timber-culture laws, &c.—Continued.

States and Territories.	1875.		1876.	
	No. of entries.	Acres.	No. of entries.	Acres.
Arizona	2	320.00	10	1,197.15
Arkansas			3	231.92
California	195	29,065.53	136	20,524.33
Colorado	27	3,453.82	45	6,514.22
Dakota	451	61,969.75	842	119,835.23
Iowa	92	9,127.52	99	8,563.42
Kansas	1,265	168,269.06	1,354	185,596.43
Minnesota	499	63,673.73	1,070	140,126.30
Nebraska	1,061	130,894.26	834	106,499.74
New Mexico			7	1,128.00
Oregon	7	882.68	13	1,793.18
Utah			3	399.88
Washington	31	3,324.14	54	5,374.28
Wyoming	1	130.47	1	160.00
Idaho	21	2,583.25	17	1,973.89
Total	3,652	473,694.21	4,488	559,917.97

States and Territories.	1877.		1878.	
	No. of entries.	Acres.	No. of entries.	Acres.
Arizona	21	2,440.00	11	1,600.00
California	75	10,586.05	60	8,029.42
Colorado	28	3,343.33	125	17,436.73
Dakota	476	68,266.92	3,769	579,804.04
Iowa	59	4,791.56	89	7,535.47
Kansas	1,666	238,020.44	4,031	593,295.17
Minnesota	561	76,021.53	2,693	377,017.78
Montana	3	398.59	9	960.00
Nebraska	706	90,812.90	1,408	195,306.68
Nevada	2	240.00	5	600.00
New Mexico			2	320.00
Oregon	19	2,509.37	130	18,446.31
Utah	3	338.50	9	1,280.00
Washington	148	19,746.75	562	78,237.00
Idaho	52	7,035.91	158	22,169.53
Total	3,819	524,551.85	13,061	1,902,038.03

States and Territories.	1879.		1880.	
	No. of entries.	Acres.	No. of entries.	Acres.
Arizona	21	3,280.00	6	719.65
California	112	14,458.81	99	12,120.31
Colorado	121	16,142.03	214	30,302.14
Dakota	4,675	728,687.83	5,575	868,748.39
Iowa	73	6,577.67	57	4,714.05
Kansas	7,776	1,167,582.77	2,891	408,261.74
Louisiana	1	80.43	1	40.00
Minnesota	1,847	257,642.50	909	123,735.36
Montana	27	3,134.20	61	6,835.32
Nebraska	3,183	465,968.94	3,202	475,275.87
Nevada	1	160.00	5	560.00
New Mexico	14	1,891.93	24	2,887.95
Oregon	130	18,446.21	482	73,061.66
Utah	9	1,280.00	35	4,044.05
Washington	562	78,237.00	893	134,637.65
Wyoming			9	240.00
Idaho	162	22,013.93	181	23,300.04
Total	18,629	2,775,502.66	14,644	2,169,484.18

Statement of the number and areas of entries under the timber-culture laws, &c.—Continued.

States and Territories.	1881.		1882.	
	No. of entries.	Acres.	No. of entries.	Acres.
Arizona	6	760.00	9	1,352.77
California	201	24,538.28	306	39,882.99
Colorado	195	26,473.31	329	47,436.05
Dakota	5,133	868,400.36	9,368	1,466,532.34
Iowa	55	3,644.25	82	6,235.62
Kansas	1,924	268,575.09	1,933	273,053.55
Louisiana	19	2,293.40	7	1,004.02
Minnesota	1,168	167,582.16	1,220	176,741.42
Montana	131	16,535.20	266	35,409.94
Nebraska	1,682	240,306.94	2,086	298,520.11
Nevada	7	1,040.00	10	1,520.00
New Mexico	16	2,039.26	24	3,351.99
Oregon	212	31,176.40	590	88,038.77
Utah	35	3,921.52	32	3,831.71
Washington	540	77,008.62	603	87,524.76
Wisconsin	1	40.00	—	—
Wyoming	5	784.30	20	2,284.44
Idaho	224	28,680.26	272	33,965.61
Total	11,554	1,763,799.35	17,157	2,566,686.09

By this table it will be seen that, since the passage of the original act in 1873, 93,246 filings, covering 13,637,146 acres, have been made. Of that amount there have been entered since the passage of the amended law in 1878, 11,177,510 acres.

Of this amount of 13,637,146 acres on which timber filings were originally made, it is safe to say, from information received from various government land offices in the prairie States and Territories, that at least one-third has, for various causes, been cancelled or entered under other acts, leaving, say, 9,000,000 acres held for the present under the provisions of the timber-culture act.

Before giving an opinion as to the practical operations of the law, attention is called to the statements of those who, from official position or other circumstances, may be supposed to have the best opportunities for practical observation of the workings of the act and the amendments it needs to make it more efficient, Hon. Charles A. Morris, register of the United States land office at Larned, Kans., writes:

I have to state, in reply to your letter, that there have been made at this office, since it opened for public business, February 15, 1875, 4,611 timber-culture entries, embracing about 700,000 acres, and of these entries there have been canceled by contest and voluntary relinquishment about one-third, embracing about 233,000 acres.

The object of the timber-culture law is to encourage and foster the growth of timber on the western prairies, and the fact that it is not more generally successful is owing to the traffic in "claims," entered under its provisions by claimants who appropriate public lands under this law for speculative purposes, and when opportunity offers, sell to homestead and pre-emption settlers; thereby not only defeating the object of the law, but forcing the new comer to pay a bonus to secure a desirable location for a home which he otherwise might have obtained at a minimum cost, to-wit, the government fees. This evil can be remedied and the law made effective, and the growth of forest trees on the western prairies assured, by so amending the timber-culture act of June 14, 1878, as to provide that land once entered under its provisions be ever afterwards appropriated thereunder, and not subject to entry under any other

law. I would suggest that section 3 of the timber-culture act, approved June 14, 1878, be amended as follows, viz:

And be it further provided. That lands once appropriated under this act shall not, in case of the cancellation of a timber-culture entry or from any cause, be subject to entry under any other law, but shall be only subject to entry under this act."

An amendment of this kind would stop speculation of the nature I have stated, and, in my judgment, insure, beyond question, the successful growing of timber in Kansas, for land once entered under this law would be thereafter forever dedicated to the successful growing of timber, and title could only be obtained, be he original claimant or otherwise, by making the growing of timber a success, and it has already been demonstrated that timber can be successfully grown even in western Kansas, by honest and intelligent effort.

E. A. Knidler, register, and C. H. Gould, receiver of the United States land office, at Miles City, Mont., present some valuable ideas about the operations of the timber-culture act in the following letter:

We would state that the intention of the act is excellent. Theoretically the law is good, but in the practical application of the same it has proved very faulty.

It is an excellent law for speculators in prospective town sites, as one person at least in eastern Montana has discovered, said person taking up a "tree claim" at the cost of \$14, and, before expending one penny for breaking, even, received \$5,000 for his relinquishment.

We are of the opinion that out here nine persons out of ten, who make timber-culture entries, do not expect to ever plant a cutting, slip, or to sow a seed of a tree.

The lands most sought after in this land district are the bottom lands along the Yellowstone, the Tongue, Powder, and Rosebud rivers, and nearly every section along and skirting those streams contains more or less timber. The average speculator endeavors to take the best bottom lands and with just as many trees upon the section, and frequently upon the tract actually entered under the timber-culture laws, as they dare or can; they hold the land a year or two, and then, if it is not contested as fraudulent, they relinquish their entry, asking that their right and fee and commissions be returned to them, upon the ground that the entry cannot be confirmed, the land not being subject to timber-culture entry. There has not been to our knowledge a cutting, seed, or a tree planted upon a timber-culture claim in this land district, but cottonwood trees have been planted in the yards and streets in town, and nearly all have grown, although the ground has never been prepared or cultivated. In our opinion, trees can be successfully raised upon prairie land by careful and intelligent care and culture.

We think the present timber-culture laws should be repealed or amended as follows, viz:

1st. The applicant should be required to swear that he personally examined the whole section of 640 acres, finding the corners of the same, and that there is not at the date of the affidavit, and apparently never has been, upon the said 640 acres any trees, shrubs or brush growing thereon, excepting —— (describing the growth). This would enable the local officers to judge by the affidavit as to the character of the land. Under no circumstances should the applicant be allowed his right and fee and commissions restored to him.

2d. When a tract of land has once been withdrawn by a timber-culture entry it should not thereafter be subject to homestead, pre-emption, scrip location or cash entry, provided the land should be properly subject to timber-culture entry. Nor should more than three timber-culture entries be allowed for the same tract, the former entry having been cancelled for relinquishment, or upon proof of non-compliance with law after contest. The tract thereafter (the three timber entries have been made) to become the property of the State, upon proof of compliance with the requirements of the timber-culture laws on the part of the duly authorized agent for the State.

This, we think, would stop speculators from taking timber-culture claims, and would have the effect of eventually establishing ten acres of good timber upon every even numbered section of United States lands, the same being prairie land.

3d. The amendment of the act, whereby the same commissions and fees are to be paid by the applicant as would be required under the homestead laws for the same tract.

Under the homestead laws the applicant for 160 acres of double minimum land in Montana, and ten other States or Territories, is required to pay at date of entry \$10 fee to the United States and commissions to the local officers of \$12, and the same commissions for the local officers at the time of proving up under the homestead law, viz., \$12. Under the timber-culture laws the fee to the government is the same, but the commissions to the local officers are only \$4 to be paid when entry is made, and \$4 to be paid when proof is made; making a loss to the local officers of \$18 for each 160 acres taken under the timber-culture laws.

Thus the law as it now exists virtually offers a premium, and makes it a great object to local officers where the maximum is not attained (and those are in the majority) to discourage timber-culture entries. We do not think the timber-culture law strong enough to carry so heavy a weight; they are too heavily handicapped.

We may be too strong in our suggestions to suit you, but the above are our honest opinions.

Loren Listoe, register of the United States land office at Fergus Falls, Minn., says:

The timber-culture act by no means has proved to be of so great a benefit to the public as had been expected, still I would consider it a great calamity and a serious mistake if said act should be repealed. It is true that a great number of acres have been entered by speculators under said act, who, for instance, hold it two or three years and then sell their rights to other parties. But on the bleak prairies of this State and Dakota I know of a great many claims which have been entered by parties, actual settlers, who honestly try to carry out the provisions of the act.

Hon. J. V. Bogert, receiver of the United States land office at Bozeman, Mont., speaking of relinquishments under the timber-culture act, says:

It is my opinion that speculation, expense and labor mainly caused the relinquishments. I do not conclude that the relinquishments, to any extent at least, are caused by the failure of trees to grow, if properly cared for.

It is my opinion that the time given in which to perfect an entry is too long; it encourages speculation in public lands, enabling parties to hold them eight years, in very many cases without planting a tree. Contests are not so often brought; parties do not like to antagonize neighbors; while the fact that inclosed or cultivated land has been taken under the timber-culture law may be, can be, and no doubt often is concealed.

I see no reason why parties should not be obliged to plant a certain area in trees, and during the first continuous summer succeeding their filing, if made *during* a summer, and during the summer succeeding filing if made *prior* to a summer. I do not notice any necessity for the first year's plowing and the second year's cultivation, if I am to judge from local success with trees without said work and use of time. Of course, I know that trees require care and ground preparation, but, were said two years not given, more compliance with the law would follow and less speculation in entries result. Again, at stated times during pendency of each case, parties should be obliged to appear at the local land office and prove compliance with the law. This would force compliance or relinquishment, and do away with eight years' withdrawal of much land.

W. E. Powell, the general agent of the Chicago, Milwaukee and Saint Paul Railroad, writing of the workings of the timber-culture act, and referring particularly to the Territory of Dakota, says:

The tree-claim law is shamefully abused in that Territory. While it was made for the benefit of the actual settler, there is no chance for him to get a tree claim at all. They are all taken up in each township by speculators in less than twenty-four hours after the township is in market. They file them under fictitious names and hold them until a settler comes and buys them for \$300 or \$400 each, but, if they cannot sell them before improvements must be made on them, they relinquish them to each other or to some unknown parties, and get new filings on them, and they can keep them so many years without any planting whatsoever, thus circulating reports among the ignorant that trees will never grow on prairie land. We will prove to the contrary.

D. S. Hall, register of the land office at Benson, Minn., says:

I have no doubt that the timber-culture law is, and has been, a cloak for covering large tracts of good land by parties who have no idea of ever complying with the law, as far as planting trees is concerned; but a slight amendment to the law, requiring the parties to promptly and strictly comply with the requirements thereof, would remedy the evil and stop the fraud.

D. S. Grimes, a gentleman of great experience in tree growing, and for many years a resident of Denver, Colo., writes:

With the timber-culture act as it now stands, the incentive to planting is to secure title. The claimant does as little as possible to comply with the requirements of the law; he has no pride or sympathy with his work only as refers to obtaining title. The planting, protection, and healthy-growing of his trees for eight years is sworn to by interested and accommodating neighbors, hence this act is often taken advantage of. To repeal this act would do the West great injustice. It should be amended so as to compel a faithful performance of the contract on the part of the claimant. Instead of one entry of 160 acres to each section there should be two entries allowed, not to exceed eighty acres each upon a section of 640 acres to be planted to timber in the same proportion as provided for in 160-acre tracts. The advantage of dividing 160 acres into individual timber entries can plainly be seen:

1st. The timber is in two plantations instead of one, and perhaps located in opposite parts of the section, and will be benefiting twice the number of settlers.

2d. One hundred and sixty acres are too much for a man of limited means to cultivate successfully: the area of land being so much greater than his ability to control, neglect and failure will result.

A State or district forester of practical experience should be appointed by government, whose duty should be to give information free to all applicants upon the subject of forest-culture. In making final proof on a timber entry the forester should first make a personal inspection of the lands claimed under the act, and if the law has been fully and faithfully carried out, then his certificate should be sufficient evidence that the law has been complied with. This will not only compel the party claiming land under the timber-culture act to be thorough in planting and cultivating, but will save to the government thousands of acres annually that would otherwise pass into the hands of dishonest claimants.

Mr. D. Pratt, an old resident of the plains country, sends the following suggestions:

I would first repeal the acts granting lands for timber culture and for pre-emption claims, and permit claims to be taken only under a modified homestead act. The changes I would suggest in the homestead act are as follows: I would allow a settler to take any number of claims he chooses, up to one section, 640 acres, with this proviso, that on each and every quarter section granted him he should plant, culti-

vate, protect, and maintain 16 acres of timber across either the entire north or south side of said quarter section. The planting I would require to be done in the following manner, viz: Previous to the first day of June next succeeding said homestead entry, he should break across the entire north or south side of each quarter section not less than four acres. And previous to the first day of each succeeding June, for three consecutive years thereafter, 4 acres more, or until 16 acres are broken. The first 4 acres should be planted within two years, of the second spring after the land is broken, and 4 acres more planted annually thereafter until the 16 acres are all planted. The land should be thoroughly cultivated the year previous to planting, and each succeeding year, till the trees are at least six years old. I would make the cultivation of the land thus granted, other than the 16 acres above specified, entirely optional with the grantee, but would require an actual residence on the land, which the timber-culture act does not.

S. M. Emery, of Lake City, Minn., says:

My personal observation in tree-planting has, in the main, been confined to the portion of the West contained in Western Minnesota, Northern Iowa, and Eastern Dakota, where many farms have been taken under the timber-culture act. These apparently have not always been successful in the production of timber, not from any constitutional difficulty in the soil but from force of circumstances, and these mostly arise from the inability of the pioneer settler to obtain suitable stock for planting, the lack of knowledge as to culture, and lack of means to give the land suitable cultivation. I have seen some very fine groves of artificial timber, mainly white willow and cottonwood. There is nothing in the working of the law that prevents the growth of timber. Land well broken and backset the first season, cropped to flax the second season, this cut, and the land plowed and harrowed thoroughly in the fall, immediately after harvest and then planted to either box elder seed or hardy seedlings; and then the same care given the crop that a good crop of corn should receive, will surely produce a magnificent growth of trees. This I know for a personal fact, having had the management of five timber claims aside from my own. The number of claimants who have profited by it small beyond doubt, as it is not a law of long standing. That there are frauds under the law we do not doubt, but it is fashionable nowadays to do this. If millions of acres of valuable pine timber can be stolen under the pre-emption act, it would not be strange if fraudulent proofs may be made on timber claims. I have thought much over the best way for government to manage the timber claim filings. It does not seem right for a man to cover 160 acres for three years, then relinquish to some other party who can do the same thing, and thus indefinitely cover and hold a piece of land. Again, the law is much abused in the planting of seed. It would seem advisable to me that a claimant in case of contest for non-compliance with the law, who should base his defense on having planted seed which did not germinate, should be made to show by at least four witnesses of unimpeachable veracity, that the seeds were actually planted and that a series of as formidable questions and answers as are needed for proof paper should be used to prove his defense. This would work no injury to innocent parties, and would certainly have the effect of making men careful. I think the law should plainly state that 27,000 trees should be planted on 10 acres in rows eight feet apart, trees two feet apart in the rows. This will admit of crop cultivation in half the soil and will leave trees in better shape for trimming. I think an annual cultivation should be required, for at least six years of the eight. It might be worthy of consideration, the idea of allowing a man to commute at the end of the fourth year from filing, provided he can prove the existence of 625 good trees on each of 10 acres by payment of \$1.25 per acre. The effect of all this would be to open up that much more land. Of course no purchaser would destroy so valuable a property as 10 acres of growing timber. * * * I am sanguine that we will yet see our bleak prairies dotted with noble clumps of timber, the result of the act.

It will be seen that the testimony of these witnesses, government officials and others, is uniform. They all state that in many instances the law fails of its main object, the extension of the forest area of the country. The great evil pointed out by all of them is everywhere the same, viz., the sale or transfer of timber claims by the original claimants to speculators and other parties.

We have already called attention to the fact that of the 13,000,000 acres filed under the timber-culture law, at least one-third has been canceled or entered under other acts. It is safe to say, with the statements herein given before us, that within a brief period, unless the law is amended, a large portion of the 9,000,000 acres remaining will be diverted in a similar manner. Admitting that the law is defective and that men are dishonest, and that they perjure themselves in regard to timber-culture claims just as they frequently do in regard to the homestead filings, is it proven that the law utterly fails of its intention; that it has accomplished no good purpose, or that it cannot be made to do so? The testimony does not show this. None of the land officers or others whose observations we have given recommend the absolute repeal of the act; they simply recommend its amendment and its enforcement. The objection made that natural causes make compliance with the law impossible, in other words that trees cannot be made to grow with proper care, is nowhere sustained. On the other hand, the evidence is overwhelming that in all the country between the Mississippi and the Rocky Mountains trees will grow under cultivation, and that no man can yet say where the line is located beyond which forestry is unprofitable.

From a mass of letters and reports from all part of this vast region we give the following:

B. P. Hanon, of Reno County, Kansas, writes:

In every instance in our knowledge where suitable varieties have been planted and properly cared for afterwards, they have grown well and proved satisfactory.

Mr. E. E. Ballou, of the United States land office at Helena, Mont., says:

I am fully satisfied that cottonwood, balm of Gilead, and box-elder, all of which are native, can and will be cultivated successfully here. The silver-leaf poplar also grows quite as thrifty as any of them. I should much regret the repeal of the timber-culture act, for I think it will prove a great blessing to this as well as other Territories if continued.

Mr. D. S. Hall, register of the United States land office at Benson, Minn., says:

No person who knows anything of western prairies will deny that planting trees thereon is the very thing of all others to make it a place to be inhabited by man. I speak from years of personal experience when I say that it is perfectly natural and easy for trees to grow on these western prairies. Where prairie fires are kept from running, groves of trees spring up at once. I know of a grove of heavy timber, containing 60 acres, which stood in the center of the prairie, miles from any other timber, in Renville County, this State. This grove was almost surrounded by water,

which protected the land from the ravages of fire. It was called Bird Island. I could refer you to any number of illustrations to show you that trees will grow on these prairies if you will only let them, and also that by the slightest effort nearly all of the valuable timber-producing trees may be successfully grown out on the prairies.

The evidence of E. T. Byram, county surveyor of Jewell County, Kansas, is to this effect:

If any one has any doubt about this matter he has only to pass through this and adjoining counties and see the beautiful small groves and windbreaks of different varieties of forest trees to be fully convinced that trees will grow on the prairies 200 miles west of the Missouri River. There has no doubt been a great deal of deception and fraud practiced in regard to timber entries; but the same may be said in regard to homesteading. I do not know how these evils can be remedied, but I do know that, although I have less than three years remaining of my threescore and ten, yet if I needed to do so I would plant forest trees with an abiding trust that I would live to reap the benefit of my labor, and that in less than ten years I would have all the fuel I would need year in and year out.

Loren Listoe, of the United States land office at Fergus Mills, Minn., gives his opinion as follows:

In this land district but three timber claims have so far been proved up; upon all of these the trees were in good condition, and one of them which I have myself inspected presents to-day as fine an appearance as if it was a regular nursery, composed of cottonwood, ash, and white willow; the trees are from 12 to 20 feet high, and some of them fit to be used for fence-poles to-day. I think it can be safely said that any man who will prepare his ground properly, and cultivate the trees after they are planted, can raise timber successfully in this State, and in Dakota, where I am acquainted.

T. G. Clark writes from Osage County, Kansas, a hundred miles west of the Missouri River:

Tree-planting on the prairies is no longer an experiment, but a successful business. The time has come in the history of this nation to encourage the planting of forest trees, and I think it unwise to repeal the timber act. I think the law should not restrict the planting of every valuable variety of trees, but let the settler plant such kinds as will succeed best.

FORESTRY AND IRRIGATION.

It is asserted that a vast portion of the interior country of the continent, including portions of the States of Texas, Kansas, Colorado, and the Territories of Dakota, Wyoming, and New Mexico cannot be cultivated without irrigation, and this brings up the very natural question, why should they not be cultivated with it? It is admitted that forests affect the rainfall, or at any rate the general humidity of the atmosphere; why should not the rule be made to work both ways, and forests be sustained by the water now available, even in the most arid portions of the country, and the forests, on the other hand, be made to preserve and increase the supply of moisture?

The great open, high, and dry country of which we are writing, estimated in extent at three hundred miles wide and eight hundred miles long, is not naturally unfertile. It is not a sandy desert, or a rocky waste, of no intrinsic value for agricultural purposes, but the soil for

the most part is a rich loam, possessing the constituent parts of rich tillable soil.

The country is not entirely destitute of water, by any means; it is traversed by the Canadian, the Arkansas, the upper waters of the Kansas, the North and South Platte, the Rio Grande, the Nebraska, the Cheyenne, and many such streams as the Cache la Poudre. These streams are alike in their character; each has a wide shallow bed, shifting channels, swift currents, and a fall of from seven to ten feet to the mile. The banks are very low and the valleys wide, and with a descent to the eastward corresponding to the fall of the streams.

With water, and a fertile soil which only needs water, why should not the two be brought together? This is, briefly, what may be termed the "irrigation question."

To consider the difficulties, first, it is said that the streams mentioned cannot be depended on to furnish the requisite amount of water at the season when it is needed. To this objection it is answered that there is every natural facility for the construction of immense reservoirs for the storage of water during the winter and the portion of the year when there is a surplus; and, further, that the great plateau is traversed by subterranean streams which may be reached by digging. The surface streams, which seem to dry up at some seasons, merely sink into the sand, and the fact is called to mind that in 1859-'60, the driest season ever known within the memory of man, when in the country west of the Missouri no rain fell during a period of nearly twelve months, water was found by digging in the beds of these streams.

The best and safest rule in endeavoring to ascertain whether a thing can be done is to secure an answer to the question, "Has it been done?" Applying this rule to the irrigation question it will be found that irrigation has been successfully carried on along the banks of the Rio Grande for the three hundred years that the country has been known to white men, and for indefinite centuries before the Spaniards landed in North America. The irrigating ditches in the valley of the Pecos may have been dug when the pyramids were young.

The results of irrigation carried on by an imperfectly civilized and unprogressive people, with the rudest implements, may be seen from the point where the Rio Grande leaves the mountains, for hundreds of miles; and amid a land which elsewhere seems cursed with eternal sterility, winds the green belt of trees and orchards, of fields and vineyards watered by the Rio Grande or its tributaries, from the garden of the archbishop of Santa Fé to the mass of verdure which enfolds the old New Mexican town of Las Cruces.

This is the work of a people with no scientific knowledge of hydraulic engineering, carried on with hoes and plows such as were in use in the days of Abraham. Can no more be done by Americans than by New Mexicans and Indians? Are the resources of modern agriculture inferior to the unchanged inventions of a Pueblo Indian? Must we aban-

don a country to desolation which Mexican peons have found capable of cultivation?

Answers in the negative are not wanting. Not to speak of the wonderful success achieved by the Mormons at Salt Lake, the scene of which is outside of the region which is properly to be discussed in this report, there may be cited what was once known as the "Greeley experiment," which is an experiment no longer. Saying nothing of the success in the direction of farming and gardening which has made the Greeley community one of the most prosperous in the United States, the growth of trees has been enormous. The cottonwoods planted in the early days of the colony are giants in size now, and other trees are growing finely and will eventually take the place of the "pioneer tree." Not far from Greeley is Fort Collins, the seat of the agricultural college of Colorado, and of the success of tree culture there, P. M. Hinman, the secretary of the college, writes:

In regard to the growing of trees in this region, I will say that there has been a large growing interest taken in the past few years, and trees are being put out very extensively; I know of some walnuts in bearing and others being planted. Should think that the next ten years will find a very rapid increase both in amount of land devoted to the growth and the kinds planted.

This is but one case. At various points in Colorado and in Wyoming irrigating ditches, to be in some cases 60 miles in length, are in course of construction. Wherever these ditches run, trees will grow transforming the face of the country. It has been noticed, too, that in abandoned ditches young cottonwoods spring up by thousands, the presence of water the year before seeming in some manner to promote their growth.

At Garden City, Kans., near the borders of Colorado, on the line of the Atchison, Topeka and Santa Fé Railroad, irrigation has been begun on a scale which bids fair within a few years to be the most extensive within the limits of the United States. The source of supply here is the Arkansas River, and the fall is so great that the water taken from the river twenty miles above Garden City, when it reaches that point, can be carried over the high plateau known as the "Second Bottom," and so an immense area is embraced within the possible limits of irrigation.

With the first beginnings of cultivation trees were planted, and their growth has been surprising. This much has been demonstrated, that there is nothing in the character of the soil to prevent a tree growth as luxuriant as can be found anywhere within the limits of the United States.

The theory that the high plains were once covered with forest, and that at a not remote period, is sustained by some remarkable facts. It is certain that the trunks of large trees are found in the bluffs or hills, miles from the water courses, and that not many years ago these giants of a century's growth were quite numerous.

Long before the settlements had encroached upon these plains, the Arkansas, the Platte, and other streams were skirted with timber which

gradually disappeared as you traveled westward. These same streams were supplied with considerable bodies of timber from the mountains eastward. The intervening distance from where the timber disappeared on the east to where it again begun on the west was perhaps two hundred miles, although in the adjoining bluffs, at points where no trees or even brush was found along the streams, bodies of old trees were found and used extensively for firewood.

The digging of irrigating canals is the signal for a heavy volunteer growth of timber along their borders, the cottonwood, the willow, and the elm predominating. Forest trees planted by the settlers or ranchmen upon the bottom lands at any point between the Missouri River and the mountains seem to live and flourish without further attention. All plainsmen remember the immense "lone cottonwood" tree that stood for a century, far removed from the Arkansas River in the vicinity of Fort Dodge, Kansas. For years large supplies of cedar were found in the hills near Julesburg, Nebr., not far from the confluence of the North and South Platte Rivers; this timber was used extensively by Ben Holliday's overland stage line even as late as 1865.

The average annual rain-fall of this great plain, which extends from the Territory of Dakota to the Rio Grande, does not exceed 12 inches. Although it is claimed that timber will not grow in a region where the annual rain-fall is less than 20 inches, and although it may be argued that the great plains are treeless because they are rainless, and not rainless because they are treeless, people who have lived on the eastern border of the great desert for the last quarter of a century and noted the climatic changes wrought in that time, and who have seen this border pushed westward several hundred miles, have faith to believe that not only will the civilization of the Missouri Valley, fostered and sustained by modern forms of agriculture, be met from the west by that sustained by artificial water supply, but that the nineteenth century will witness the highest forms of horticulture and agriculture successfully practiced upon an unlimited scale in the very heart of this now treeless and rainless desert.

KNOWLEDGE IS POWER.

The great gain so far made is that of knowledge, and to this great gain every discussion, every report, every experiment, every success, every failure even, has contributed. The too enthusiastic have learned moderation, and the despondent have been encouraged. No man who has looked over the ground will maintain that all kinds of trees will grow in the high prairies and plains that grow in lands of mists, rain, and mountain, and, on the other side, no thoroughly posted and practical prairie farmer or plains-man will say that trees will *not* grow even in the constantly diminishing precincts of the "American desert."

SUITABLE VARIETIES.

It has been decided what trees grow best in the prairie States, and a hundred tree planters selected from different localities in the States and Territories, embraced in this report would, if called upon, report the same varieties. They are the ash, black walnut, box elder, cottonwood, honey locust, Osage orange, silver maple, catalpa, Russian mulberry, white elm, and gray willow. It is not to be understood that no other forest trees will grow; many other trees are indigenous; but it is to be understood that where a selection is to be made these trees are most available. In selecting others the chances of losing time and money are increased.

PROPER METHODS OF CULTIVATION.

In addition to this useful knowledge certain points have been reasonably well settled in regard to the cultivation of these trees, and we give these directions in the language of one of the most successful foresters in the country, Mr. C. H. Longstreth:

Trees should be planted closely, for immediate and mutual protection; second, for economy in culture; third, for the purpose of securing valuable timber and early returns from the planting. There evidently was a want of practical knowledge with our law-makers on this question when they framed and passed the timber act allowing trees to be planted 12 feet apart each way. Trees planted such wide distances can never serve the purpose of a forest, but will virtually become an open orchard.

Propagation.—As a general rule the best and cheapest mode of growing trees for timber is by means of the seed; some kinds, such as the cottonwood, the willows, and most of the poplars, may be readily propagated from cuttings.

Preparing the ground.—In preparing the soil for planting of seeds and young trees it is essentially necessary that the ground should be deeply plowed and well pulverized.

Distance apart.—We have practiced planting in rows 4, 6, 8, and 12 feet apart, with trees 2 to 3 feet apart in the row, the results so far being in favor of rows 4 feet apart. Trees that naturally grow upright may be farther apart than those of a spreading habit. In no case would we recommend putting the rows over 6 feet apart.

Planting.—Seeds that start with a delicate growth should be planted in nursery rows, or in a seed bed, to be transplanted to the forest at one or two years old; seeds and cuttings of a vigorous growth may be planted right out in the forest rows. The nut-bearing trees do not transplant well, and the seed should be planted where the trees are to remain. We would advise, most decidedly, not to allow your trees in nursery rows to get more than two years old before transplanting; and they are better transplanted at one year old. One-year old trees are sure to grow, having, in proportion to the top, more and better small fibrous roots. Young trees cost less throughout in handling and planting, and in the end make a larger, thriftier, healthier, and better tree every way. Be careful not to expose the roots of trees in handling; set them one or two inches deeper than they stood before, and press the earth firmly about the roots.

Cultivation.—To be successful in the growing of trees it is essentially necessary that they should receive good, thorough cultivation. You might just as well expect to grow a crop of corn without cultivation as a crop of trees. Too many people allow their trees to die or be ruined for want of a little care and cultivation, and then complain that tree-growing is a failure. Neglect is a failure everywhere. Cultivate well in the early part of the season; allow no weeds or grass to grow; stop all cultivation with the plow after the middle or last of July, this being done in order to let the trees

have time to ripen their wood and be in good condition for the winter; pull or hoe out all the weeds that may come in late in the season. In plowing among trees a short whittle-tree should be used to avoid injuring the trees. All trees planted in the spring should be ridged the following November by turning a furrow against them on each side with a light plow; the ridges may easily be leveled in the spring with the cultivator. After three or four years, or as soon as the trees shade the ground, they will need no more cultivation, and will thereafter need but little care. Be careful to keep stock from running among the trees, as they are very injurious, even after the trees attain a large size.

Pruning.—This is a subject that has been much discussed, and in regard to which there are various opinions, some even contending that trees should not be pruned at all. I shall consider it here only in relation to forest culture. When there are more than two leading shoots they should be cut out to one, leaving the largest. Any side branches which detract in size and vigor from the leading shoot should be shortened or cut off entirely. This is all the pruning we find necessary in a closely planted forest; nature will do all other pruning.

Thinning.—Here is where we get our early returns. Several of our rapidly growing trees, if they have been properly planted and taken care of, may, in four or five years, be thinned out to advantage, care being taken to leave the straightest and most vigorous trees; then thinning gradually as the trees grow larger.

In a convention of nurserymen and tree-growers it is quite probable that there would be found gentlemen to take exception to these rules. It is also true that these directions were given originally for the benefit of Kansas tree-growers; yet Mr. Longstreth's views as to varieties, close planting, and cultivation have been indorsed by tree-growers and men of experience all over the country, west of the Missouri, writing without consultation with each other.

THE BEST TREE.

Something has been learned, too, of the relative value of trees. Limited as the list seems, few persons will care to plant them all, and a choice must be made. In making the selection we should advise as the first choice the black walnut. It seems for the first three or four years a slow grower, but after that period it grows rapidly; and admitting that the soft-bodied trees grow faster at the start, they are of little value when grown, while the black walnut has an actual money value greater than that of any other American forest tree. It should be the Western forester's main reliance; but between the walnuts experience has shown that other trees should be planted which put forth their leaves earlier, though they may not be worth so much for their wood, such as soft maples, box elders, or cottonwood. The latter have the further advantage of compelling the black walnut tree to run up straight and high, and they serve to shelter and protect it from the hot sun and drying winds.

INFLUENCE OF DISCUSSION.

The varieties best for planting and their mode of cultivation having been definitely settled, the next great step is to ascertain and employ the best means to foster and encourage the work of tree-planting. In this direction much has been done. Societies, notably the Forestry

Association of Minnesota, have done much, and meetings like those of the American Forestry Congress at Cincinnati and Montreal have excited general interest. It is certain that never before in the history of this country has forestry been so generally a subject of interest among all classes of people.

THE FUTURE OUTLOOK.

It is but nine years since the timber-culture act, the first law of Congress designed to encourage tree growing, was passed. It is only four years since the law was so amended as to encourage action under it. The first timber claims are now being proved up, and the advantages and demerits of the law are now fully known. The subject has already been discussed in these pages. There can be no doubt that Congress will take action and so amend the law as to prevent fraud, and embody in the law the condition, "once a timber claim, always a timber claim," and so give an immense impetus to tree-growing on the prairies. Thus, with increased and increasing knowledge; with enlightened self-interest, and the government of the nation pledged to the protection of the forest lands, still the common property of the people, from spoliation, the encourager of the honest settler under the timber-culture act, and in time, the active promoter of schools of forestry, we have much to hope for.

WHAT SHOULD BE DONE.

In a country like this, where the power of the general government is scarcely known or felt, reliance must be placed upon the voluntary action of the individual. In European countries, where the government regulates everything, even to the amusements of the people, a system of forest laws can be adopted making the planting and preservation of forests obligatory, but such a system cannot be inaugurated here. The government cannot here compel all men to set out trees or care for them; and it is questionable if it can give much successful encouragement in the way of bounties. On the other hand, the Government of the United States has a right to take care of its own. A quarter-section of land in the prairie or on the mountain side is, until it is conveyed by the government to a corporation or individual, as much the property of the United States as is the Capitol at Washington, or a fort or vessel flying the flag of the United States. It is as much the duty of the general government to protect that quarter-section from invasion or spoliation as it is its duty to save the Patent Office or Treasury buildings at Washington from robbers or incendiaries. Of course, the letter of the law recognizes this principle, but no laws have been more systematically violated than those designed for the protection of government lands. The theory has obtained that these lands belong to the first settlers, and that their product is to be used by them for their own individual benefit, under the plea of "Developing the resources of the country." Every man who has cut cord-wood on the government land and sold it and put the money in his pocket has justified his course by saying that

the operation "developed" the country and thus increased the value of the government land itself. Nothing can be more pernicious in theory or practice than this. These lands do not belong to the first settler or the first thousand settlers who may come into their vicinity; nor the first corporation which may gain a foothold. They belong to the nation, which is the trustee for fifty millions of people. A citizen in Maine has as much interest in them as a citizen in Kansas or Colorado.

SPOLIATION OF GOVERNMENT TIMBER.

In regard to the forest lands still the property of the United States, the question has arisen, shall they be protected for the benefit of the country and of generations yet to come, or shall they be reduced to desert wastes for the private benefit of speculators and corporations? Take the case of the government forest lands in Colorado. Twenty-four years ago the slopes of the Rocky Mountains were covered with the untouched forests sufficient, if properly cared for, to supply the *reasonable needs* of the settler and miner, as contemplated by the law, till the end of time. In the shadow of these forests rose the headwaters of the Rio Grande, Platte, and the Arkansas, and the snow in the deep woods melting slowly, the rise of the streams was gradual and uniform for a long period. To-day these mountains are being left peeled and bare. The mountain side is being converted into a bald, bleak desert, the springs are drying up, and the Rio Grande, Platte, and Arkansas now rise with sudden violence and then sink as suddenly in their dry and diminished beds. In other words, the people of Colorado, Kansas, and New Mexico are having inflicted upon them incalculable injury, and a wrong is being done which, if not arrested, will affect disastrously generations yet unborn.

In return for this devastation of its property the government receives nothing; its magnificent estate is laid waste, and it gains nothing in the way of recompense. The land is nominally in market at \$2.50 an acre in bodies of 160 acres to one individual, but it is not being purchased to any extent. With a view of aiding the poor settler or needy miner, a law was passed some years ago allowing him to take timber for domestic use, meaning thereby, evidently, his personal use, for fencing, firewood, or lumber necessary in the actual construction of his mining shaft. The law was certainly liberal enough, and was so liberally interpreted by the settlers that it was found necessary to send government agents to the spot to protect the rights of the government; but since that period the words "domestic use" have been interpreted to mean the right of the "party of the first part" to cut timber and sell to other parties for their use. Under this ruling there were lying in one mountain stream in September, 1882, half a million railroad ties, indicating by their length that they were intended for the "domestic use" of a broad-gauge railroad outside of the limits of Colorado, where the narrow-gauge is the usual standard. This is but one instance. Movable

saw-mills traverse the country, using up every tree valuable for sawed lumber; these are followed by the railroad-tie cutters, who take every tree large enough for one tie; to complete the work, charcoal-burners follow, using every stick that is left. We have before us a pamphlet setting forth the advantages of a Colorado town, and therein is the statement that within a radius of ten miles sixty charcoal-kilns are running, with a capacity of 4,000 bushels each per month, and representing a monthly distribution of \$30,000. This charcoal is being made from wood belonging to the United States, which receives therefor no compensation of any sort; and, moreover, the actual settler in the vicinity is being deprived of the wood granted him for his own use, and is being forced to go miles for wood enough to cook his food; and last, and worst of all, drought and desolation are being invited in order that a few individuals may reap a temporary profit out of the government.

HOW THE FOREST MAY BE PROTECTED.

The few illustrations offered may serve to give an idea of the situation along the whole eastern slope of the Rocky Mountains, so far as occupied by miners or penetrated by railroads and railroad-tie cutters. It is safe to say that no other government on earth, liberal or despotic, would suffer itself to be thus despoiled; and in this country the offense is greater because it is not the robbery of some prince, potentate, or individual, or class of individuals, but of the whole people. The evil is glaring and evident, and the remedy should be prompt and certain. It is suggested that the most effectual is the *withdrawal of all government-timbered land from market*, and the sale of the timber under government regulation in such a manner as to protect the forest from extinction. To illustrate, the forest lands might be divided into districts of reasonable extent, each under care of a government inspector, whose duty it shall be to supervise the forest growth, to bring trespassers to justice, and to see that only such trees are sold as can be spared without detriment, or whose removal would be advantageous, or that no trees below a certain size shall be cut on tracts designated. It should also be made his duty to exercise oversight of tracts from which the merchantable timber has already been removed, to see that the young growth is not injured, and especially that it be protected from fire. In the beginning, for what is done should be done at once, this duty should be performed by capable and discreet men, without any personal or property interest in the districts committed to their charge; men acquainted with the value of timber and its habits of growth, and, above all, men of incorruptible character.

GOVERNMENT FORESTERS.

To the end that this duty, which is to be perpetual—for it should be understood that the government forests are never to be destroyed—there should be a body of young, energetic, and practical men educated by

the government, and standing in the same relation to it that the graduates of West Point and Annapolis do, competent, faithful, and fond of their work of preserving to the government and people of the United States a domain greater in value than all its mines of silver and gold. To raise up this class, there should be established such a number of national schools of forestry as may be found necessary, care being taken that the schools are distributed in the different sections of the Union according to climatic division and the character of their natural forests, as, for instance, the white-pine regions, the southern pine and cypress country, the regions where the walnut, maple, elm, and deciduous trees are the prevalent growth, and the high prairies and treeless plains and mountain slopes where, most of all, the forester is to find work.

SCHOOLS OF FORESTRY AND EXPERIMENTAL FARMS.

Attached to each of these schools there should be an experimental farm, where every tree known to the United States should be planted, and in certain localities, as determined by their natural dryness and altitude, the methods of irrigation as applied to forest culture should be thoroughly tested.

With these two questions of reforesting the plains—we use the word reforesting because it seems evident that forests once grew on the plains—and also of the possibilities and value of irrigation to be determined, the suggestion has been made to the writer that the general government should in some manner establish a series of experiments, or rather a continuous test, to scientifically settle the matter. Given a treeless region, eight hundred miles long and three hundred wide, to be reforested, largely by means of irrigation, there should be, in the opinion of thousands of intelligent people, some point selected where on an extensive scale trees may be planted, the different systems of irrigation applied, and results noted, and this through a series of years. This would settle, perhaps, that in some districts, generally embraced in the arid region trees may be grown *without* irrigation. This is the opinion of Mr. D. S. Grimes, of Denver, a gentleman of vast experience. Mr. Grimes believes that trees planted in “dead furrows” and mulched will in four years shade the ground sufficiently for their own protection. This theory might with others be tested to the great benefit of all concerned. In the Western country individual scientific interest combined with munificence cannot be relied upon to establish and maintain such an institution as a school of forestry and experimental farms. The land-grant railroad companies may in time plant forests to test the capability of their lands or to raise trees for their own use, but they have no interest in educating foresters. The States, with their agricultural colleges, have no sufficient facilities. It seems, then, that the general government should enter upon the work. The Government of the United States, acting for the people, has the greatest interest. In years past it has expended millions in the exploration of this vast domain.

It has expended millions in warring with the hostile savages who have roamed over it. It has a second mortgage on the great railroads which traverse it. The Government of the United States, being the greatest land holder, also has a paramount interest in reclaiming this empire and converting it from a wilderness to fields, gardens, orchards, forests, and pastures. That the government should actually do the work is not to be expected, but it seems to be reasonable to expect that it should aid in doing it. Knowledge is power; and let the government furnish the knowledge. The government owns the land; it can set apart any amount of it which may be required; it can place the work in the hands of the best practical talent of the country; it can do on a large scale what individuals are doing on a small scale. As the government is impersonal and can be accused of no sinister or selfish interest, the statements put forth under the sanction of the government officers and agents will be received as the truth. It will be shown what trees can and what cannot be grown on the plains; what are the effects of copious and limited irrigation; what is the actual amount of water required for given areas; what is the result of irrigation on the same land for a series of years; and, most important of all, what is the effect of planting large bodies of trees—actual forests.

AMENDMENT OF THE TIMBER-CULTURE ACT.

So far the only legislation by Congress intended directly for the encouragement of practical forestry is what is known as the timber-culture act. It has been several times amended, and needs further amendment. It has been so long in existence that its faults are well known, and there should be no hesitation in remedying the law, that its original purpose should be carried out as far as the intention of any law is attainable.

The law contemplated that when a quarter section was taken as a timber claim, it should be held as such until the terms of the law had been fully complied with, and a certain number of trees had been added to the forest area of the country. The intention of the act, according to the testimony of government officers and other competent witnesses, has been avoided; non-residents and speculators have taken claims under the timber-culture act merely for the purpose of selling them to persons who wished to take them as homesteads or pre-emptions. It will be readily seen that this is an absolute avoidance. It works a failure of the object of the act. The remedy for this seems to be the adoption of the principle, "*Once a timber claim, always a timber claim.*" By this is meant that when a filing has been made under the timber-culture act, the land should be withdrawn from entry under either the homestead or pre-emption acts, so that the title shall never be perfected except in compliance with the letter and spirit of the timber-culture act.

The law is defective in allowing trees to be planted as far apart as

twelve feet. Young trees need each other's support. Close planting is the law of nature, and nurserymen are more and more coming to recognize it, west of the Missouri at least. Taking the ground that the object of the law is to have the ground covered with live trees and not dead ones, the greatest distance allowed between trees at planting should be four feet. If the trees when growing become too thick they will be trimmed out by nature herself.

TIMBER ON HOMESTEADS.

The power of the government over public lands is absolute. It can, in conveying them, impose any regulation not in hostility to the "general plan of granting the public domain to actual settlers under reasonable conditions." In addition to the actual occupancy for five years now required, the homesteader might with profit to himself and advantage to the country be required to plant and maintain during the five years one acre in forest trees, or set a row of trees along the highway, or both.

WHAT STATES MAY DO.

Except in Texas, where the State owns all the public land, the States own nothing but the school lands and lands granted for educational purposes. The power of the States over them is absolute, and in their sale the condition might be imposed on the purchaser that a certain portion of the land shall be kept in forest. The legislatures of the several States may take action making it obligatory on school directors to maintain trees on school-house grounds, and also making it compulsory on land owners to keep trees growing along the country roads.

DUTY OF RAILROAD COMPANIES.

The duty and the interest of the great land-grant railroad corporations lie in the direction of the encouragement of forestry. Next to the general government, these companies are the greatest land owners on this continent. They have received from the government and municipalities, from the people, in short, an imperial gift, the source of immeasurable wealth, and this has been given them almost without conditions. It is but just that they should in return do everything possible toward the improvement of the country their lines traverse; and it is also their interest to do so, since whatever increases the productivity of the country increases their own business. These corporations, with their great and hourly increasing wealth, can do what individuals cannot do, and on them devolves the inauguration of the plan of planting great forests—not little experimental gardens, not a few trees in the depot grounds, but tracts such as are found in Europe of tens of thousands of acres. It is estimated that every year 275,000 acres are stripped in this country to furnish railroad ties, and the process of restoration must keep pace with that of destruction, else the time will come

when railroad ties cannot be secured at any figure. Why should not a great railroad company, with millions of acres at its disposal, raise its own railroad ties? We have spoken elsewhere of the very praiseworthy experiments of the railroad companies in the direction of tree-planting. But the experience of tens of thousands of practical men, farmers and others, has shown that as far as Minnesota, Iowa, Kansas, and Nebraska are concerned, the era of experiment has passed. It is, for instance, as well known now as it ever will be, that the catalpa, the black walnut, the osage orange will thrive, and that they may be profitably cultivated. Instead, therefore, of continuing the discussion of a settled question, the railroad corporations should set out trees; not by the hundreds of acres, but by the thousands. This is a case where timidity, conservatism, and niggardliness mean loss. There are many ways, too, in which railroad corporations may foster the forest interests, as the distribution of forest-tree seedlings, nuts, and seeds. A private firm, R. Douglas & Son, of Waukegan, have sent out millions of trees in packages by mail. A great railroad company could do this on an even greater scale with the prospect of a sure return. In a few years they would not be obliged to seek remote and almost inaccessible mountains for ties, but would have them growing within sight of their own tracks for hundreds of miles. We do not doubt that the facts here set down will be recognized as the truth sometime, but every day of delay is a day of loss. But after the national government has done what it may, after State governments have done what lies in their power, the question of reforesting and of supplying with forest the region now destitute depends upon the people, and their action depends on an affirmative answer to the question, "Does it pay?"

LET US PLANT FOR OURSELVES.

We have, in a previous chapter, demonstrated that the planting of forest trees *does* pay; but the evidence which can be given within the limits of a report like this is but a drop in the ocean of procurable testimony. From the sandy plains of Cape Cod, swept by the bitter winds of ocean, where pine plantations have successfully been cultivated, to the sage-brush plains of Colorado, the answer is the same, that trees as a crop are profitable, paying as surely as corn or the other cereals. Those who have not made the subject a study have no conception of the amount of printed matter that has been and still is constantly accumulating on this subject; the observations of individuals, the reports of committees, the transactions of societies, cover hundreds of thousands of pages, and in them all there is not the evidence of a single human being to the effect that he had lost time or money in planting trees. Much sentimental talk has been indulged in concerning our duty to the next generation. We should plant trees, it is said, under which our grandchildren may repose. This is doubtless a fine and ennobling sentiment, but the average American citizen cares little

for the generation preceding him, and nothing for the generation to come; he expects the next generation to provide its own shade. The question he wishes to determine is whether the trees he plants will benefit men in this generation. Curiously, people almost always overestimate the age of trees. Who has not heard a great elm or oak spoken of as centuries old when it really has grown within the lifetime of living men? Trees are a sure crop, and, after all, a quick crop. The homesteader who goes out on the raw prairie knows that it is five years before his farm can be producing crops with anything like regularity. His trees are making a return as soon as his fields are. The Mennonite settlers in Kansas, of whose success we have spoken, in seven years, at the farthest, from the time they turned the first sod, are literally sitting in the shade of the trees they planted; are raising their own firewood, and eating the fruit of their own mulberry trees. What these settlers from Russia, strangers to our climate and soil, can do, others can do. It must be remembered, too, that the objectors have had their day; every argument which can be used against the cultivation of forest trees has been used in the prairie States west of the Mississippi against the cultivation of fruit trees. For example, men accustomed to hillside orchards in the old States have demonstrated to their own satisfaction that apples would not grow in Kansas; but wagons full of round and rosy evidences to the contrary may be seen standing in the streets of every Kansas market town. The number of those who till the soil, be it a bit of garden ground or acres by the hundred, who believe in the profitableness of trees, is constantly increasing. In front of the humblest cottage in town you see the three or four maples or elms covering the front of the lot; and out on the wide prairies, as far as settlement has extended, the group of planted trees marks the outpost of the picket guard of civilization. It is with the hope of contributing in some way to this useful and beautiful pursuit, which is to shelter the bare and blistered earth; which is to catch and hold the rain and the dew; which is to shelter the home and its occupants from summer's heat and winter's cold; which is to bring fuel and comfort to the housewife; and which is to increase by millions the well-earned wealth of a nation, that this brief report is submitted to reading and thinking people.

Respectfully submitted.

F. P. BAKER.

TREE PLANTING AND GROWING ON THE PLAINS.

Hon. GEO. B. LORING,
Commissioner of Agriculture:

SIR: This paper is intended only as a brief presentation of experiences and results concerning tree culture and tree growing on the western plains, made by and coming under immediate observation of the writer during a residence of twenty-seven years west of the Missouri River, in the Territory and State of Nebraska, the principal object being to show what has been done practically, is being and may be done, converting a naturally timberless portion of country into a tree-growing region. Taking the geography of boyhood days, together with official reports of Captain Miles, United States Army, and the western explorer, Colonel Fremont, relating to that portion of the national domain situate between the Missouri River and Rocky Mountains, as a basis for conclusions, there was at date of extinguishment of Indian title to these lands in 1854 nothing enticing to enterprising adventurers seeking new homes in the far West, especially in matters of tree-growing. The thought that the then naked plains would ever be transformed into groves of valuable timber was not entertained. Those who first came, during the years 1854-'55-'56, soon discovered, however, that, particularly along the borders of streams and where prairie fires were kept out, there was promising spontaneous indigenous growth of valuable varieties of timber—oaks, black walnut, hickories, elms, ashes, red mulberry, honey locust, hackberry, linden, soft maple, sycamore, Kentucky coffee tree, red cedar, cottonwoods, willows, and others. Still later it was found by experiment that native seedlings transplanted into carefully prepared soil did well on high uplands—out on the open prairie not only did well, but grew with remarkable vigor and rapidity, showing characteristics of excellence in quality. To those of indigenous growth were added in time varieties of foreign origin—hard or sugar maple, American chestnut, white walnut, poplar, beech, birch, black locust, larch, pines, catalpa, black cherry, and others. While success followed efforts in this direction, only the most sanguine adventurous experimenters had faith in ultimate practical results. In time, through an act of the Territorial legislature, creating a board of agriculture, the labors of the board organized under its provisions, and afterwards liberal legislative appropriations, keeping out annual fires, and other aids and precautions, tree-growing in Nebraska is universally conceded a success. There is now no hesitancy or risk in predicting in the near future that it will be known and characterized as a timber-producing region of country.

EXTENT OF TREE PLANTING AND GROWING.

But little tree-planting was done in Nebraska, and by reason of annual fires sweeping very generally over the country spontaneous growth was exceedingly meager, for at least ten years after organization of the Territory, and first efforts by settlers to improve and develop. To cover all the ground and afford a more satisfactory presentation of the subject-matter under consideration, commencement is made with date of passage of Kansas-Nebraska act, 1854. From that time up to and including the year 1882, covering a period of twenty-eight years, official statistics, with some reliable estimates to cover dates not thus provided, it is found there has been planted within the borders of what is now the State of Nebraska 244,356 acres of forest trees. This includes seedlings, seeds, and cuttings planted in permanent forests, groves, and along highways and streets in cities and villages. Spontaneous indigenous growth, since fires have been kept from borders of streams and ravines, is estimated equal to half the area planted.

Personal observation would warrant a larger proportion. Not a few informants contend for an equal extent; some higher, even to double. James T. Allan, Omaha, ex-secretary American Forestry Association, now in employ of the Union Pacific Railroad Company, traveling extensively over the State, responding to inquiries on this particular point, writes: "I have watched the spontaneous growth of young elms, walnuts, oaks, ash, hickories, &c., along the Missouri, Wood, and other rivers in the West, since fires have been kept back, and seen their growth among the hazel brush, which is the fringe on the border of native timber, dividing it from the prairie. I hardly think I am out of the way in setting it at double the amount of timber planted."

A majority, however, in various parts of the State, place the estimate as stated—at one-half.

It is safe to say a majority of planting is made, originally, four feet by four, with view to cutting out first one-half, as growth demands space, and eventually another half of that remaining—three-fourths in all. Some plant six by six, others eight by eight. Planted four by four we have 2,622 trees to the acre, or a total of 640,701,432; eight by eight, 682 to the acre, or a total of 166,680,792. Average the totals, and there is shown 403,676,112. Add to the average the spontaneous estimate, one-half, and the grand total is, planted and grown in 28 years, 605,514,168 trees.

The number of trees per acre, spontaneous growth, will more than equal one-half the acreage planted. It is estimated one-fourth of the trees, seeds, and cuttings planted did not grow, and therefore not now occupying the ground. Spontaneous growth, except where the weak have been crowded out by the strong, and such as may have been destroyed by occasional fires, it may be said all are growing.

DEMONSTRATED USEFUL AND VALUABLE VARIETIES.

It has been practically demonstrated that the following valuable varieties of forest timber can be successfully and satisfactorily grown—both planted and of spontaneous growth. Only the most valuable are named in this list. Those designated with a * are indigenous.

Ash:

- Fraxinus Americana.**
- viridis.**
- quadrangulata.**
- pubescens.**
- platycarpa.**
- sambucifolia.**

Oak:

- Quercus alba.**
- obtusiloba.**
- macrocarpa.**
- prinus.**
- tinctoria.**
- rubra.**
- nigra.**

Chinquapin oak—*prinoides*—of shrub character, grows in abundance, particularly on the bluff lands adjacent to the Missouri River, and in places in profusion on prairie lands, many acres in a body. It is a profuse bearer; nuts equal almost to chestnuts. In early days it was considered a “Munchausen” story when old settlers talked of hogs eating acorns from trees. The small growth, often not over a foot high, was loaded with nuts, and therefore easily eaten off by swine. Deer and antelope fattened on them.

Black walnut:

- Juglans nigra.**

White walnut:

- Juglans cinerea.*

Hickory:

- Carya alba.**
- sulcata.**
- tomentosa.**
- porcina.**
- amara.**

Elm:

- Ulmus Americana.**
- fulva.**
- racemosa.**
- alata.**

Hackberry:

- Celtis occidentalis.**

Honey locust:

*Gleditschia triacanthus.**
*monosperma.**

Kentucky coffee tree:

*Gymnocladus canadensis.**

Linden:

*Tilia Americana.**

Sycamore:

*Acer pseudo-platanus.**

Black locust:

Robinia pseudacacia.

Soft maple:

*Acer dasycarpum.**

Sugar maple:

Acer saccharinum.

Sugar maple grown thus far little else than for ornamental purposes—lawns and street trees. There is no reason why it may not be grown successfully for forest purposes, as it thrives well when introduced and planted.

Poplar:

Liriodendron tulipifera.

Wild black cherry:

Prunus serotina.

Wild red cherry:

*Prunus Pennsylvanica.**

Catalpa, hardy:

Catalpa speciosa.

Cottonwood:

*Populus monilifera.**

*heterophylla.**

Willow:

*Salix purpurea.**

*cordata.**

*longifolia.**

*nigra.**

Valuable characteristics are noted of a willow growing spontaneous along the Missouri River from the mouth of the Big Nemaha, south, to the Yellowstone, north, familiarly known as "Diamond willow." Professor Sargent names it *Salix cordata*, var. *vestita*. Experience demonstrates it as durable for underground uses—posts—as red cedar.

Box-elder:

*Negundo aceroides.**

Chestnut

Castanea Americana.

Pine:

Pinus sylvestris.
Austriaca.
strobos.

Red cedar:

Juniperus Virginiana.

Larch

Larix Europaea.
Americana.

Mulberry:

*Morus rubra.**
alba.
moretti.

Many varieties of less value than the foregoing, embraced in a complete sylva of the State, are here omitted as not of practical value for forest purposes.

GROWTH OF TREES.

The following actual measurement of tree growths, of known ages, are made, showing circumference in inches two feet above ground:

Names of trees.	Years old.	Inches.
White elm (p)	15	24 $\frac{3}{4}$
Red elm (s)	24	36
Catalpa (p)	20	48 $\frac{1}{2}$
Soft maple (s)	18	54 $\frac{3}{4}$
Soft maple (p)	18	69 $\frac{1}{4}$
Sycamore (p)	16	43 $\frac{1}{2}$
Pig hickory (s)	24	37 $\frac{1}{2}$
Shagbark hickory (s)	24	30
Cottonwood (s)	23	78 $\frac{1}{4}$
Cottonwood (p)	23	93
Chestnut (p)	14	24 $\frac{1}{2}$
Box elder (s)	14	25 $\frac{1}{4}$
Box elder (p)	14	31 $\frac{1}{2}$
Honey locust (s)	22	40 $\frac{3}{4}$
Honey locust (p)	22	41 $\frac{1}{2}$
Kentucky coffee tree (s)	14	25 $\frac{1}{2}$
Burr oak (s)	22	36 $\frac{1}{2}$
White oak (s)	22	29
Red oak (s)	22	37 $\frac{1}{2}$
Black oak (s)	22	38 $\frac{1}{2}$
White ash (s)	22	32 $\frac{1}{4}$
Green ash (s)	22	30
Black walnut (s)	22	48
Black walnut (p)	22	50 $\frac{1}{2}$
White walnut (p)	22	49 $\frac{1}{2}$
Osage orange (p)	25	26 $\frac{1}{4}$
Larch (p)	10	24
White pine (p)	20	36 $\frac{1}{4}$
Scotch pine (p)	15	23
Austrian pine (p)	15	22 $\frac{1}{2}$
Red cedar (p)	15	26 $\frac{1}{4}$
White cedar (p)	15	22
Mulberry (p)	18	43
Mulberry (s)	18	39 $\frac{1}{4}$
Linden (s)	14	35
Poplar (p)	4	12
Black locust (p)	24	60 $\frac{1}{2}$
Red willow (p)	20	58
Gray willow (p)	15	26 $\frac{1}{4}$

s, spontaneous growth. *p*, planted growth.

ORDER OF VALUE.

The order of ultimate value, deciduous varieties, while there may be difference of individual opinion, it is safe to arrange: white, burr, and chestnut oaks; black and white walnut; white, green, and blue ash; black cherry, catalpa, black locust, honey locust, Kentucky coffee tree, elms, hickories, larch, soft maple, hackberry, mulberry, cottonwoods, willows, box elder.

For present or near value, cottonwoods—especially the yellow—are almost universally conceded preferable. There are, as shown, two varieties, yellow and white—*monilifera* and *heterophylla*. The yellow makes excellent lumber, particularly for inside uses, not exposed to weather. For shingles, only pine, cedar, or walnut are superior. Both make good fuel, after reasonable drying or seasoning. Old steamboat and mill men prefer half-seasoned cottonwood to any other obtainable in this region, claiming they get more steam from it; also much used in burning brick. No other wood holds nails so well.

Red cedar, white, Scotch, and Austrian pines stand in order of value as evergreens, and are usually so planted.

ORDER OF PLANTING.

The order of tree-planting, numerically speaking, of deciduous varieties is, as near as may be, cottonwoods, box elder, soft maple, elms, ashes, black walnut, honey locust, catalpa, oaks, hickories, Kentucky coffee tree, black locust, larch, sycamore, hackberry, mulberry, black cherry, and willows. Two-thirds of the whole are cottonwoods, from the facts they are more easily obtained, cost less, are of more rapid and certain growth, and from which realizations are more speedily and certainly secured, and, in addition, succeed almost anywhere planted.

SPONTANEOUS GROWTHS RANGE IN ORDER OF VALUE.

Oaks: red and black, perhaps, predominating; hickories: more shagbark than others. Black walnut, elms, linden, white ash, mulberry, and hackberry on higher lands; on bottoms, cottonwoods, box elder, willows, sycamore, soft maples, green and water ash.

PRICE OF FOREST-TREE SEEDLINGS.

Prices of forest-tree seedlings are such as to place them within reach of the very poorest; in fact, as the great bulk planted are of spontaneous origin, they are to be had for mere gathering in regions where found. When trafficked in, prices range, owing to variety and size, from six inches to four feet, all along from fifty cents to three dollars per thousand; nursery-grown plants grade higher. Many millions are now planted annually.

ENCOURAGING ENACTMENTS AND PROVISIONS.

The Nebraska State constitution provides that "the increased value of lands by reason of live fences, fruit and forest trees grown and cultivated thereon shall not be taken into consideration in the assessment thereof." A State law "exempts from taxation for five years \$100 valuation for each acre of fruit trees planted, and \$50 for each acre of forest trees;" also makes it obligatory that "the corporate authorities of cities and villages in the State shall cause shade trees to be planted along the streets thereof."

Further: "Any person who shall injure or destroy the shade tree or trees of another, or permit his or her animals to do the same, shall be liable to a fine of not less than \$5 nor more than \$50 for each tree injured or destroyed."

To encourage growing live fences the law permits planting "precisely on the line of the road or highway, and for its protection to occupy, for a term of seven years, six feet of the road or highway"

ARBOR DAY.

This day originated in Nebraska through action of the State Board of Agriculture. It is a day designated by the board during planting season, each spring, usually about the middle of April. The board annually award liberal premiums for the greatest number of trees, cuttings, and seeds permanently planted on that day. The governor annually, by proclamation, recognizes the day for purposes indicated, urging the people to devote it exclusively to tree-planting. It is very generally observed, and millions of trees planted that day.

MODES OF PLANTING AND TREATMENT.

The usual distances apart are by multiples 4, 8, 12, 16, &c., that intermediate ground may be utilized by being cultivated in other crops until trees are of sufficient size to protect themselves, when, in farm parlance, they are permitted to "take the ground."

Most experimenters at first planted tree seeds where they were to remain permanently. Experience has shown this a mistake, for numerous reasons. Principally, by this mode, uneven stand, growth, grade, size, and vigor are to contend with. By planting seeds first in beds, and, say at one year's growth, assorting, grading, and transplanting permanently each grade to itself, better results are secured. The same grades as to size and vigor do better together; grow more evenly; the weak are not crowded out or overshadowed by the stronger—a practical illustration of the "survival of the fittest."

By this plan small plants, if healthy, do about as well in the end as the large. No variety is known that cannot be safely transplanted at one year old. Even varieties of tap-root characteristics—oaks, walnuts, hickories, and chestnuts—are really better, I am convinced, for tap-root

pruning. By it laterals, or fibrous, feeding roots are induced; or, if larger sizes are desired before transplanting, root pruning, by running a tree-digger under rows and allowing them to remain a year or two longer, good results are obtained. As a rule, however, better success is had by transplanting young trees when, as near as possible, all roots are preserved. Small trees cost less to purchase, transport, handle, and transplant. Alternating, especially certain varieties, has not given satisfaction. Trees in some respects are not unlike mankind—will not fraternize. For instance, oaks, walnuts, and hickories will not fraternize with maple, cottonwoods, and elms. When planted near each other, the latter will invariably lean away from the former, assuming crooked, gnarly appearance, and in the end virtually die out.

INCIDENTAL ILLS.

Thus far few ills have attended timber culture in this State. The great losses or failures have been from careless handling, planting, and after neglect. Black locust was planted extensively in earlier days, but, being so badly affected by borers, its cultivation, until of late, was almost entirely abandoned. The pest which almost universally destroyed it in the beginning, suddenly and without known cause disappeared, and that valuable variety of timber is again receiving merited attention. In certain portions of the State, during one or two years, a large green worm, name not known, defoliated most soft maples, for a time checking their growth. In a few instances the same borer attacking black locust, to a limited extent injured soft maple and cottonwoods. They being of such rampant growth, injury was not material. Trees attacked were principally those used for ornamental purposes—those on streets in cities and villages.

Where ground has been well and deeply prepared, good healthy plants used, care exercised in handling and planting, followed by attention and proper cultivation until able to care for themselves, there has been no good cause for complaint.

IMPORTANCE OF SPONTANEOUS GROWTH.

Too much importance cannot attach to spontaneous timber growing. Nature, in this respect, is both accommodating and bounteous in her provisions. Waste places, as a rule, are utilized. Lands which, if at all adapted to other uses, could only be prepared at extra expense, are those nature occupies and renders of value. This growth comes of its own accord, so to speak, without preparation or labor by man, other than to guard against fires, along broken and often precipitous bluffs and ravines, in nooks and corners of tortuous and meandering streams incident to prairie regions. A belief is freely expressed that greater proportionate successful tree-growing, and at comparatively no expense, has been done by nature than by planting. As stated before, by a far

greater proportion of such planting and growing stands and succeeds than that of artificial processes. Losses are rare, and only from occasional invading fires, and, where too thick on the ground, the stronger kill out the weaker—no loss in fact—simply adjusting or equalizing. Personal knowledge is had of many instances where lands, twenty and twenty-five years ago, considered worthless, are now valued at from twenty to one hundred dollars per acre solely for the timber naturally grown.

ROBERT W. FURNAS.

BROWNVILLE, NEBR., *December 1, 1882.*



